GOOD PRACTICE GUIDE 315

Energy and Resource Management

# Fuel, Power and Water

## A guide for managers in the minerals industries

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GOOD PRACTICE GUIDE 315

# Fuel, Power and Water

## A guide for managers in the minerals industries

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First published February 2002

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# Foreword

This Guide is part of a series produced by the Government under the Energy Efficiency Best Practice Programme. The aim of the programme is to advance and spread good practice in energy efficiency by providing independent, authoritative advice and information on good energy efficiency practices. Best Practice is a collaborative programme targeted towards energy users and decision makers in industry, the commercial and public sectors, and building sectors including housing. It comprises four inter-related elements identified by colour-coded strips for easy reference:

— *Energy Consumption Guides:* (blue) energy consumption data to enable users to establish their relative energy efficiency performance;

— *Good Practice Guides:* (red) and *Case Studies:* (mustard) independent information on proven energy-saving measures and techniques and what they are achieving;

— *New Practice projects:* (light green) independent monitoring of new energy efficiency measures which do not yet enjoy a wide market;

— *Future Practice R&D support:* (purple) help to develop tomorrow's energy efficiency good practice measures.

If you would like any further information on this document, or on the Energy Efficiency Best Practice Programme, please contact the Environment and Energy Helpline on **0800 585794**. Alternatively, you may contact your local service deliverer – see contact details below.

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# Contents

# Acknowledgements

The assistance of the following companies in the preparation of this Guide is gratefully acknowledged:

- AGGREGATE INDUSTRIES UK LTD
- FOSTER YEOMAN LTD
- GREAVES WELSH SLATE CO LTD
- E & J W GLENDINNING LIMITED
- HANSON AGGREGATES
- JOHNSONS WELLFIELD QUARRIES LTD
- LAFARGE AGGREGATES LTD
- R J MAXWELL & SON LTD
- RMC AGGREGATES (Eastern) LTD
- RMC AGGREGATES (South West) LTD
- TARMAC GROUP

# Introduction

# Introduction

**This Guide is specific to the mineral and mineral products industries. These include quarry, ready-mixed concrete, and coated stone, but exclude lime burning and cement.**

The Guide has been prepared to help site managers in the mineral and mineral products industries to effectively tackle energy (power & fuel) & water management on their sites.

Occasionally, the term energy management is used in this Guide. It should be taken to include water management. (Mains water is an energy-intensive 'product', with energy costs being around 10% of production costs.) Traditionally, fuel economy is the term used for energy efficiency in the transport sector; where relevant it is used in this Guide.

Within the minerals sector, energy & water management is seen as part of good environmental management. This Guide promotes the belief that good environmental management cannot exist without effective energy & water management.

Three approaches to energy & water management in the sector have been identified:

- **PC & Desk**

  Data collection and analysis, policy, procedure, etc.

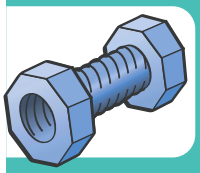
- **Boots & Hardhat**

  Walking the site and looking for opportunities (also includes aspects of site supervision).

- **Nuts & Bolts**

  Plant changes, modification, engineering specifications, etc.

Successful sites use an appropriate combination of all three approaches.



## Why bother?

### Money

It is estimated that the minerals sector uses around 10 million MWh of energy a year, at a cost in the region of £150 million. Savings of 10%, which are achievable, would boost the sector's profit by some £15 million a year. What share of that £15 million is yours?

If you don't already know, find out what you spent on energy & water in the last 12 months. What would a 10% reduction in that spend mean to your site's profitability?

### Environment

Due to its nature, the minerals sector is one that is subject to close environmental scrutiny. As such, it needs to take every opportunity to improve and demonstrate its environmental performance. The consensus of scientific opinion is that energy production and consumption has significant environmental impact.

### What can you achieve?

- To save money and increase profits.
- To improve the overall efficiency of your site.
- To demonstrate a commitment to the environment.
- To work for the future.

## Using this guide

This Guide provides a structured approach to developing energy & water management at a site level.

It is based on six stages:

STAGE 1 Getting Started
STAGE 2 Facts & Figures
STAGE 3 Policy & Structure
STAGE 4 People & Procedures
STAGE 5 Engineering & Investment
STAGE 6 Continuous Improvement

No matter where you are with energy & water management, Stage 1 provides the starting point.

It is unlikely that energy & water management is your full-time job. Accordingly, this Guide has been developed so that you can tackle the work in easily digested pieces. It is recommended that you document your progress, for two main reasons: it will help you keep track of what you have done and what you are going to do; it will also prove useful if you have to hand over responsibility to someone else.

A range of support material is included in the Toolbox section.

Although this Guide includes all the advice necessary to develop a successful approach to energy & water management, reference to other material may be required. Details are included at appropriate points in the text.

### Before you start

It is suggested that you skim through the Guide initially, to find out what it covers and where it will lead you. Then, complete the **QUICK SITE PROFILE** (in the Toolbox). This will give you an immediate assessment of your energy & water management status.

*STAGE 1*

# Getting Started

one

## STAGE 1

# Getting Started

**Good management does not just happen. Carrying on as you always have done will produce the same results that you have always had. Changes need to be made, but where are you going to start?**

Planning is a critical success factor, but to develop a workable plan you need to know where you are now and where you want to be. Having completed the Quick Site Profile you will have some idea of where you stand in the energy & water management stakes. Now you need to start work in improving your rating.

## What You Need


To complete this stage you will need:

- some time – it should be possible to complete Stage 1 in under a week, with part-time effort;
- good site knowledge;
- energy (power & fuel) & water bills for at least 12 months (24 if possible);
- production figures (tonnes) for the same period as the energy & water figures;
- copies of energy contracts and tariffs;
- access to a PC and spreadsheet (alternatively, paper and calculator!);
- Energy Consumption Guide (ECG) 70, *Energy use in the minerals industries of Great Britain*, or ECG 47, *The mineral industries of Northern Ireland*.

## Scope

Ideally, you should look at the total operation. However, if your resources are limited, at first you may not want to look at everything. If so, you need to define your scope by selecting from:

- fixed plant* – crushers, coating plant, etc;
- mobile plant* – loaders, trucks, etc. within quarry/coating plant;
- offices and ancillaries – heating, lighting, etc;
- road haulage – off site, public highway.

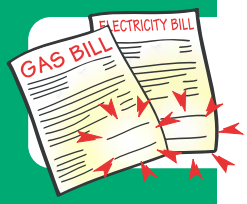
*Note: *To calculate Specific Energy Consumption you must look at both fixed and mobile plant (see page 8).*

Having set your scope you need to collect the basic data so that you can start to quantify and compare.

# Bills, Meters and Measurement

## Bills

The starting point for all energy & water management is the bills. A 'good' copy of a bill should give you consumption, cost, and information on the tariff or supply contract. If you do not have copies of bills on site, then request them from the accounts department. Copies going back a number of years should be available, as they are required for tax purposes. (In some large companies, energy & water management information may be compiled centrally. Find out if it is and get the data that you need.)




Electricity is supplied by the kilowatt-hour (kWh) or unit. Many gas suppliers also bill by the kWh. Since a common unit is required, it is recommended that all energy is calculated on the basis of the kWh. This may involve the use of conversion factors. (Since it is not possible to convert water into kWh, use the volume measure on the bill, e.g. cubic metres.)

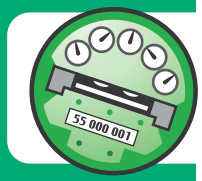
**Conversion factors to kWh**

| Supply | Unit | Conversion factor |
|---|---|---|
| Gas oil (Diesel) | litres | x 10.6 |
| Reclaim oil | litres | x 10.8 |
| Natural gas | therms | x 29.3 |

It is recommended that you get the bills covering a period of at least 12 months, preferably 24. For each supply, e.g. electricity, gas oil, water, enter details of consumption and spend into a spreadsheet. If you have data for 12 months you can produce annual totals and average unit costs. You may also want to plot some charts of consumption and cost.

If you have data for over 12 months you can plot Moving Annual Totals. Each point on your chart is the sum of the previous 12 months. This reduces the effect of possible meter-reading errors, allows for seasonal variations, and provides a trend line of consumption and cost.

## Meters




Typically, every site will have at least one electricity meter – most likely the billing meter for the supply. Errors in billing can occur, so it is a good idea to check this meter's readings regularly.

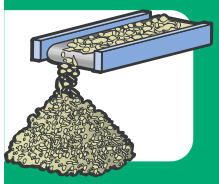
Ideally, all energy use for the site should be metered. However, for some fuels, e.g. waste oil, measurement may be by means of tank contents. (Make sure you account for stocks and deliveries when using tank contents to calculate consumption.)

It is worthwhile producing an inventory of meters. This should include location, type of meter, units of measurement, and a unique identifier, e.g. a serial number. Some sites will have sub-meters, for instance where there is another operation on site, e.g. ready-mixed concrete, or coating plant.

Points to note:

- Electricity meters are usually accurate (billing meters are typically better than ± 1%) and, when digital, relatively easy to read.
- Gas meters record volume (cubic metres or 100s of cubic feet), so the calorific value is needed to convert to energy. You may also have to adjust the volume figure for pressure and temperature correction.
- Water meters are often located in situations that make reading difficult, and can be inaccurate if the flow rate is below the minimum the meter was designed for.

### Production measurement



At this stage, the most important non-energy measure required is production – in tonnes. If you are using a spreadsheet, add appropriate production figures to the sheet with the energy & water consumption figures. If you have different products, then production by product should be collated. This is critical if the site has both clean stone and coated stone.

### Tariffs and contracts

Although it will not reduce energy consumption, a review of the tariffs and contracts may provide cost savings. There are competitive markets for all energy supplies, so effective purchasing is essential.

One way of reducing costs is to find a lower-cost supplier. Another is by checking how your current consumption pattern matches the tariff. For example, if you have minimal night usage of electricity and are on a day/night tariff, it may be worth looking at a fixed-rate tariff. Are you paying for a much greater supply capacity than you use? Should you be managing heavy power loads to avoid high tariff costs?

This point marks the completion of the initial PC & Desk work. You now know how much you are spending each year and what you are spending it on.

## Site Walkabout

While some energy & water management is PC & Desk, there comes a time to get out of the office and walk the site. This is the Boots & Hardhat part of energy & water management.

The objectives of the initial walkabout are to identify:

- the major energy & water-using plant (if not already known);
- energy & water supply, storage, and metering points;
- obvious energy & water wastage.

Ideally, this is best done by two people, one of whom has a good working knowledge of the site.

### Major energy & water-using plant

Identifying the major energy & water-using plant should be straightforward. You probably already know what it is. However, it is worth taking the opportunity to look at this plant from an energy & water viewpoint. Noting details of motor sizes and other energy & water relevant details is also worthwhile.

### Energy & water supply, storage, and metering points

Inspect all the known energy & water supply, storage, and metering points. Check that the relevant points for each service have been identified and mark them on a suitable site plan. (While doing this, take a note of meter readings and, when back at the desk, compare them with those on the latest bill.) Make a note of any access or safety issues relating to these items. A metering point that is difficult to access may result in estimated readings. **For energy & water management, estimated readings have very little value.** If there is tanked storage, check on arrangements for bunding – oil spillage is a major environmental issue.

### Obvious energy & water wastage

At this stage you are not looking for anything more than poor housekeeping or bad maintenance. Examples include: plant running but not loaded, lights left on, missing insulation on heated tanks, hoses or sprays running when not needed.

# Initial Benchmarking

You now have all the basic information you need to initially benchmark your site. So, off with the Boots & Hardhat and back to the PC & Desk!

Energy use will vary depending on production volumes. Therefore, the key figure you need to calculate is the Specific Energy Consumption (SEC) in kilowatt-hours per tonne (kWh/t). This can then be compared with the sector averages given in ECG 70 (ECG 47 for Northern Ireland). Page 17 of ECG 70 has an energy use calculator that shows you how to do this. (**Note:** The SEC should include **all** 'on-site energy'.)

For the benchmark to make sense, you need to compare like with like. Exact accuracy is not critical at this stage, with SECs ranging between 8.3 and 15.4 kWh/t for most 'rock and gravel' sites. However, ready-mixed concrete at 3.6 kWh/t and coated stone at 108 kWh/t can have a significant effect on the SEC for a mixed-production site.

If you do not have separate energy figures for such operations, then a 'weighting' process can be used to determine an initial SEC for comparison.

**SEC weighting should only be used for the initial assessment; on-going use of weighted figures is not recommended.**

### Weighted SEC

A site has production figures of 80% clean (igneous) stone and 20% coated stone. The weighted average would be 0.8 x 15.4 + 0.2 x 108.2 = 33.96 kWh/t. (Note: Such figures should be used with extreme care, as a small error in estimating the production level of the coated product could have a significant effect on the weighted average figure.)

# Making Sense of the Results

You now know how much energy & water you use, how much it costs, the SEC for your operation, the SEC for your sector, and you have identified obvious energy & water wastage.

Looking first at the SEC. If you are above the sector average, then it is most likely that there are savings to be made; if you are below the average, savings may still be possible.

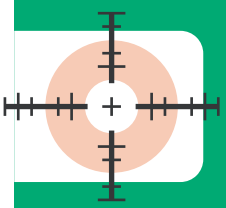
When comparing with the sector averages, look at the spread. Clearly, there is a range of site-specific issues, e.g. rock hardness, restoration, overburden, haul-road gradient, etc. that will affect the SEC. For example, the igneous crushed rock SEC ranges from 5.0 to over 27.5 kWh/t. Typically, larger sites have lower SECs, due to economies of scale.

The other point to note is that the sector averages are based on data collected in 1996 (1994 for ECG 47). Many sites will have improved on performance since then, so it is likely that the current sector average is lower than that published in ECG 70.

You should also look at how your SEC is made up. What percentage is fixed plant, mobile plant, etc? Consider preparing a pie chart to show the breakdown.

With the data you have collected you can now estimate the business impact of reducing energy & water costs by 10% (a reasonable target for any site that has not been active in energy & water management). A 10% cost saving is money that will become increased profit. What production tonnage would have to be produced and sold to make the same profit?

# HIT LIST



Having completed the above steps you will be able to list a number of immediate and low-cost actions that can be taken. These need to be formalised and implemented as soon as possible. The sooner this is achieved the sooner you will start making savings.

Typical actions in the **HIT LIST** might include:

- Install additional metering to segregate coated and clean stone.
- Reduce idle running time of mobile plant.
- Take regular meter readings.
- Fix compressed-air leaks.
- Check for water leaks.
- Improve tank and pipework insulation.
- Review blasting to optimise rock size to crushers.
- Reduce crusher(s) idle running times.
- Improve haul-road condition.
- Increase recycling/re-use of water.

If you have a site with a coated-stone facility (sector SEC over 100 kWh/t), this plant must be at the top of your list. The energy for one tonne of coated product could be used to produce around 10 tonnes of clean stone.

Prepare your **HIT LIST**, set people to work, and then move on to Stage 2.

*STAGE 2*

# Facts & Figures

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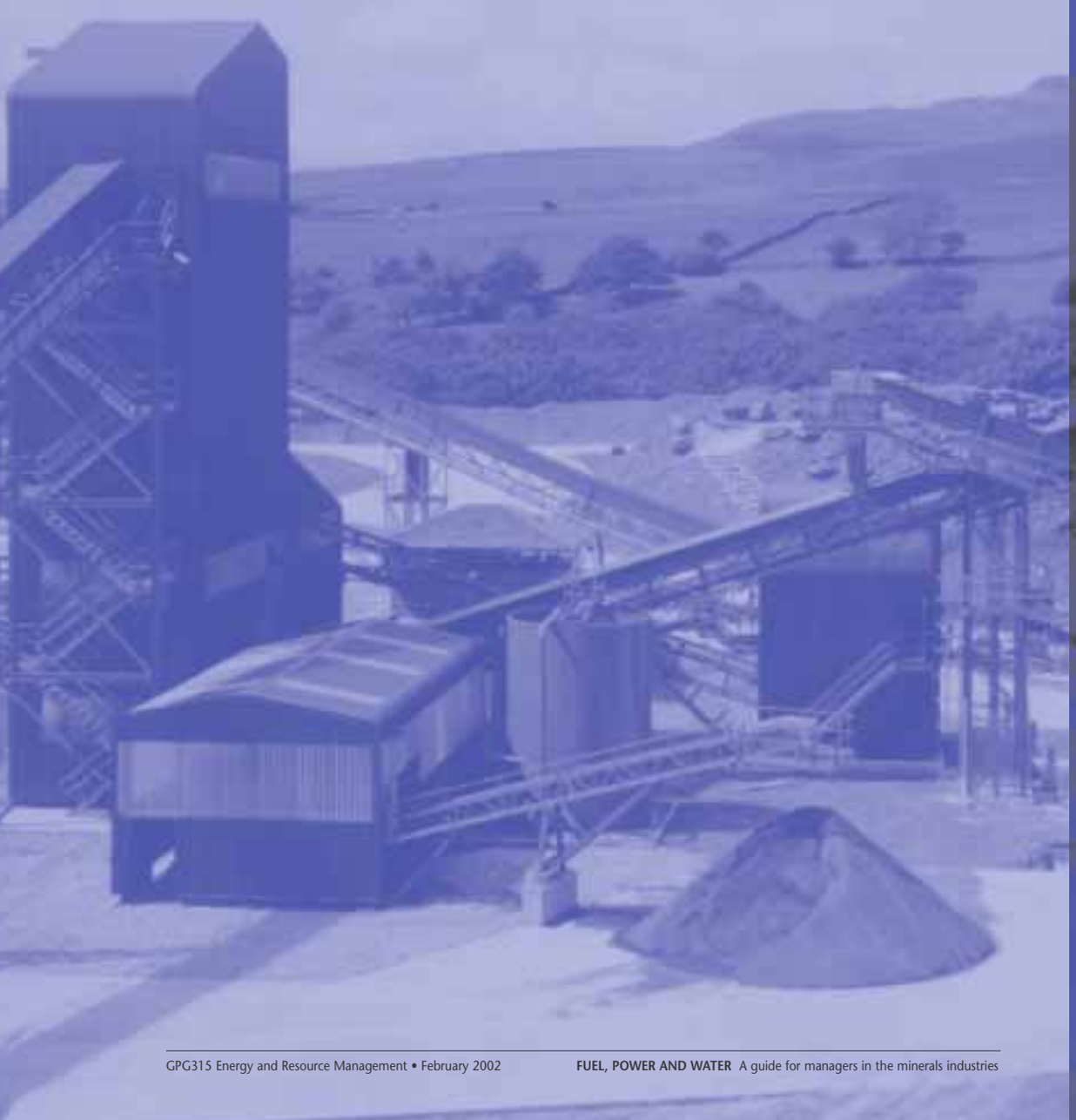


## STAGE 2

# Facts & Figures

**"You can't manage what you can't measure" is an almost overworked adage. Any problems you might have encountered with Stage 1 are likely to have concerned the availability and interpretation of data.**

For Stage 1 you needed only a 'snapshot' of consumption and costs. To be successful at energy & water management you will need an on-going supply of relevant information.

With the **HIT LIST** being implemented, you now need to develop an information system to support on-going energy & water management.

From Stage 1 the value of 'segregated data' should be apparent, i.e. it enables you to relate consumption data to specific site processes, e.g. between clean and coated stone. Having only aggregated data for the site limits the analysis and performance monitoring that can be carried out.

As a rule, where a significant dissimilar process takes place on site it should be metered separately. For example, all coated-stone plants should have independent metering that will allow the energy used by that plant alone to be determined.

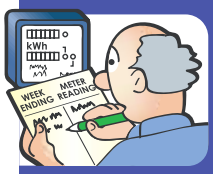
## What to Collect?

There is little point in collecting data for data's sake. You should collect only the minimum required to meet your needs. The two main reasons for collecting data are:

- to see how well (or badly!) you are doing;
- to help you decide what to do next.

You need figures that are regular **and** reliable. **(Estimated readings will not do.)** These figures are needed for all energy & water sources, and production. Hopefully, adequate recording of production is in place; if not, you have an important production and business issue to address!

### Electricity




If your site is a significant user of electricity, then you will have half-hourly metering in place. This means that your electricity bills are monthly and for the exact calendar month. You may also have access to the raw half-hourly data. If so, you have a high-quality data collection system in place. All you have to do is work out how to use it! If you use on-site generation, then the generator fuel input is the energy figure that you need to calculate the overall energy cost.

If you have sub-meters, it is most likely that they will need to be physically read, i.e. someone will have to go the meter and note its reading, as opposed to reading it electronically. The issues around meter reading are looked at later in this section.

## Natural gas

As with electricity, a piped natural-gas supply will have metering that is read by the utility supply company. If you are going to take your own meter readings, check if there is a pressure & temperature-corrected reading output installed. Usually, this will be an LCD-type display adjacent to the in-line meter.

## LPG

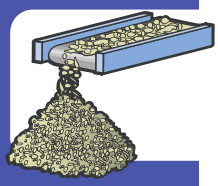
The arrangements for LPG vary according to quantity and supplier. At a low level of usage the only measure you may have is the size and number of cylinders used. Larger installations may be metered.

## Gas oil, reclaimed oil and diesel

These will normally be held on site in storage tanks. All tanks should have some form of contents gauge. This might be sight glass, a 'cat and mouse' indicator or a graduated contents gauge. The 'worst case' scenario will be a dipstick. At the other end of the scale will be in-line metering. For mobile plant and road haulage there may be 'metering pumps' in place. If so, it may be worthwhile recording the fuel dispensed to specific plant items. Sophisticated key-based fuel dispensing systems can also be used. These are often used for supply fuel to road-going vehicles. Some suppliers of mobile plant can provide sophisticated monitoring equipment that records fuel consumption, acceleration, gear changes, etc.

## Water

The utility company will meter the incoming or town's main supply. Water meters are relatively inexpensive, so installing sub-meters may not be too costly, assuming there is easy access to the pipework. At low flows, water meters may fail to register, so correct sizing is important. A worthwhile check for water is to isolate all usage on site and see if the main meter is still recording a flow. If it is, you have either missed something or you have a leak; there is no point in paying for water that is lost into the ground! (The same approach can be used with electricity, to check that you have identified all the usage on site.)



## Production

How good is the measurement of production? Is it consistent? If you are looking to save 10% energy, is the quality of the production data accurate enough? It's true, you can measure absolute energy consumption, but for effective assessment of performance in a variable production environment, you need to relate energy & water to production. The methods and accuracy of production should be reviewed as part of the work in this stage of the Guide.

## Plant activity

You may find it worthwhile to record the activity of particular plant items. This might be a simple case of hours run, e.g. a haul truck, or hours run loaded, e.g. an air compressor. Where possible, use a measure that is already recorded, or one that can be easily recorded without additional monitoring equipment.

As well as numerical measures, it is worth ensuring that some form of activity 'log' is maintained. Again, this may already be recorded. You need to be able to easily determine if plant operation has changed. Have working hours been extended? Has a plant item been refurbished or replaced?

If you have on-site generation it may be worthwhile recording kWh generated against fuel input. You can then assess the efficiency of generation and compare it against purchased electricity.

### Road haulage

To monitor road haulage (public highway) effectively you need to collect data on fuel use, mileage and activity (loaded/empty). The calculation of miles per gallon is a familiar monitoring technique that is at the heart of fuel economy monitoring.

# Meter Reading


### How often should you read meters?

In Stage 1 you looked at annual figures. Obviously, important as an annual review might be, you need to look at the figures more often than once a year. At the other extreme, it will be difficult to justify reading all meters on a daily basis. For a typical site, monthly figures will probably be most workable. Arguably, with coated stone using around ten times the energy of clean stone, weekly monitoring of a coating plant may be appropriate. If suitable systems are in place, batch monitoring may also be possible and appropriate.

**Possible metering or monitoring periods**

| Item | Resource | Batch | Weekly | Monthly |
|---|---|---|---|---|
| Crushers | Electricity | | | ✔ |
| Coating plant | Gas | ✔ | ✔ | |
| | Electricity | ✔ | ✔ | ✔ |
| Mobile plant | Diesel | | ✔ | |
| Offices | Electricity | | | ✔ |
| Ready-mix plant | Water | ✔ | ✔ | |
| Road transport | Diesel | | ✔ | |

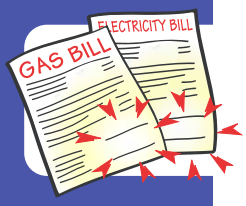
### Meter-reading issues

Experience indicates that many mistakes are made when reading meters. Sometimes this is because the type of meter, e.g. a dial electricity meter, is not easy to read properly. On other occasions a simple reading error may be to blame, e.g. 34596 becomes 34956. Mistakes can also be made over the units of the meter, e.g. recording cubic feet instead of cubic metres.

Take time to find out how to accurately read the meters that you have on site. Train more than one person to read them. **Always** double-check the first meter reading. If it is wrong, then all subsequent readings can be wrong in the same way - and undetected.

If you are not confident that a meter is accurate, consider having it checked. This may cost money but accurate data are important. A portable energy monitor may indicate the accuracy of the meter, as well as providing other data for analysis.

Consider the data collection services offered by your utility. Costs may range from £200 - £300/meter/year, but may be worthwhile.




### Invoice issues

One of your data sources will be the invoices issued by the utility. As part of good energy & water management these should be regularly checked. Errors on invoices are not unknown, e.g. incorrect readings, use of the wrong tariff, billing the incorrect site, etc.

It is also not uncommon for the accounts department to place a stamp or sticker over the critical energy information on the bill. The accounts people are interested in the net amount, the VAT, and the total bill. You want to know a lot more; you want kWh, unit rate, tariff, etc. Another accounts problem is the assignment of a bill to a month. The bill for the energy supplied in November will be received in December. So, for most accounts departments this will be called the December bill.

Some invoices are multi-page, with much valuable information on the attached pages. Always ensure that you are receiving a full copy of the bill.

## TO DO!

- **Determine what metering you need and install any additional metering.**
- **Establish appropriate procedures for meter reading.**
- **Review production-monitoring procedures.**
- **Decide on a management-reporting cycle that your data will support.**

# What to Do with It

Arguably, you cannot define what data you need to collect until you know what you are going to do with it. Alternatively, you can only do something with the data you can easily/economically collect. This is a chicken and egg situation. You may need to go round the loop a time or two to refine the system.

There are four main things you can do with the collected data:

- Assess consumption and costs.
- Determine performance indicators.
- Identify trends in performance.
- Learn more about the processes/activity on site.

For most sites, a PC spreadsheet will be a readily available tool for data analysis. Commercial software for energy monitoring and analysis does exist, but don't consider this until you have analysed some data yourself, using a spreadsheet.

### Recommended reading:

Good Practice Guide 231, *Introducing information systems for energy management*.

The following techniques should be considered:

- regular calculation of total energy & water consumption and cost;
- regular calculation of (segregated) SECs, i.e. SEC per product;
- use of moving annual totals, averages or SECs, for trend analysis;
- lines of best fit to determine standards of performance;
- CUSUM analysis (needs an established performance standard);
- annual audit (energy & water balance for the site);
- annual calculation of carbon dioxide emissions for environmental reporting.

**Carbon dioxide conversion factors can be found at the Energy Efficiency Best Practice Programme web site:**
**http://www.energy-efficiency.gov.uk/**

It is impossible to be totally prescriptive about what a site should do. However, there is no reason why all sites should not be carrying out the first three techniques listed above.

## TO DO!

- **Experiment to find out what techniques are best for your site.**
- **Select those techniques that you understand and consider useful.**
- **Consider the use of commercial software or monitoring services.**
- **Run the system in 'ghost' until you are happy to go public with the output.**

# Who to Tell – and What to Tell Them

You must never forget why you are collecting and analysing data. You are doing it to save energy & water and increase profits. It is unlikely that you are the only person on site who needs energy & water information. Different people need this for different reasons; the accountant might want a prediction of future energy & water costs, the coating-plant manager may want batch-specific performance data.

In general, people are working in conditions of potential information overload. As a result they want the minimum amount of information necessary, often in a 'pre-digested' form. Telling someone they had a SEC of 18.9 kWh/t last month is of little value unless they know what it should be, or are told that it is good, bad or indifferent!

Everybody on site needs some energy & water information; they also need to know what impact they can have on energy & water performance. Does the crusher operator have any idea what the crusher uses if it is running unloaded? Do haul-truck drivers know what the idle cost of their vehicle is?

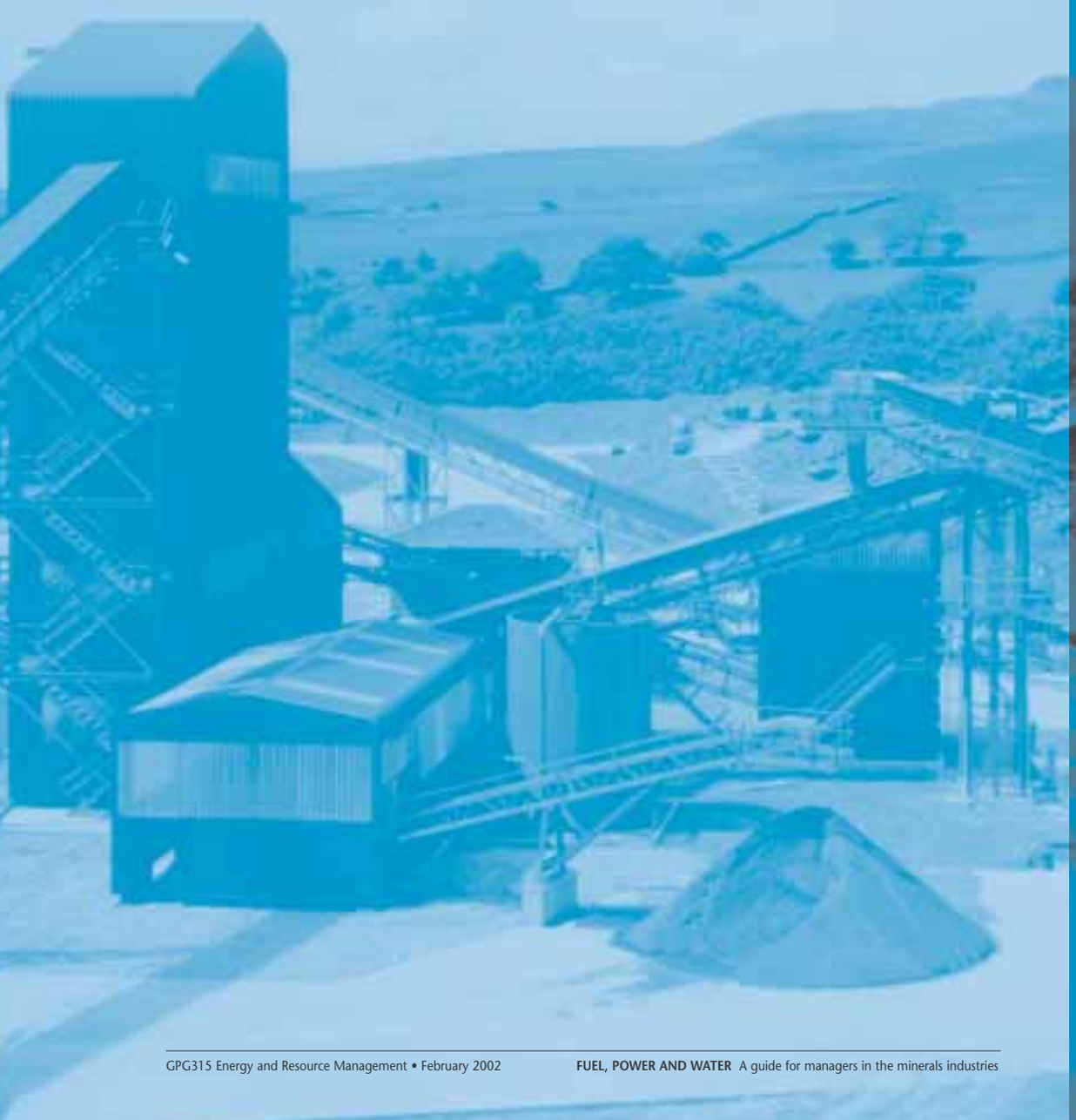
## TO DO!

- **Find out what information people need – ask them!**
- **Find out the most effective ways of delivering this information.**
- **Find out what other sites/industries do.**
- **Don't be afraid to experiment!**

*STAGE 3*

# Policy & Structure

three



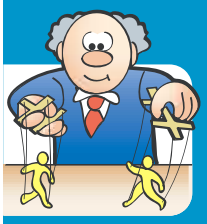
## STAGE 3

# Policy & Structure

**Although savings will have been made from the HIT LIST, sustained energy & water management is needed to gain the full benefits. The Energy Efficiency Best Practice Programme (EEBPP) has demonstrated that, for lasting results, a site must adopt a structured approach to energy & water management.**

This stage looks at the issues involved in formalising energy & water management and its integration with other systems on site.

## Responsibility & Control



Energy & water management is effective where energy & water users have 'ownership' of the issues. If energy & water are simply regarded as a general overhead or 'an act of god', then it is unlikely that significant progress will be made.

Clearly, the site manager has overall responsibility, but placing all the responsibility at this level limits the 'span of control' on site. Ideally, elements of energy & water responsibility should exist in all job descriptions, much in the same way that everyone has health & safety responsibility.

While everyone on site should have energy & water responsibility, there are usually a small number of people who can have a significant effect. These people need to be clearly identified and 'charged' with their responsibility. Typically, they might include the coating-plant supervisor, the site engineer, and shift managers.

Although responsibility can be devolved through job description and instruction, control is often effected through work procedures. You do not need to develop new, discrete procedures for energy & water. An addition to existing quality or work procedures may be all that is needed.

It is worth noting that the production of poor-quality output can effectively waste energy & water. For example, sub-standard coated stone or concrete that has to be dumped increases the energy & water used for the same output.

### TO DO!

- **Identify the people on site who should have a defined (written) energy & water responsibility.**
- **Implement formal energy & water responsibility.**
- **Review existing work procedures to identify where energy & water management should be included.**


# Policies for Resource Management

For many organisations, formal, written policies are needed to implement changes in management. Policy statements also make the management's intentions clear and 'public'.

Policies can exist at differing levels within an organisation, e.g. a high-level energy & water policy that is 'supported', in turn, by purchasing policies for equipment.

For many sites, the environmental policy will be at the highest level, with energy & water being a clause in that policy. The typical form may be, "we will seek to minimise our use of natural resources, including energy & water". While this gives status to energy & water saving, it does not tell anyone anything beyond a good intention.

The development of a 'strategic' policy can help clarify what the company wants to do and how this will be done. The strategic energy & water policy document does not need to be any longer than one side of A4 paper. It should be drafted in language that relates to the site/company. When drafting it, avoid including items that will cause the document to become dated or discredited. For example, do not say, "we will reduce energy consumption by 10% in the next year", instead say, "energy reduction targets will be set each year".

Experience shows that involving people in the drafting of a policy statement normally leads to a policy that has wider ownership and is, therefore, more effective.

An example energy & water policy is included in the Toolbox.

### Background reading:

Good Practice Guide 186, *Developing an effective energy policy*.

Good Practice Guide 200, *A strategic approach to energy and environmental management*.

## TO DO!

- **If an energy & water policy is in existence, review and revise as necessary.**
- **If you do not have an energy & water policy, draft one to meet your needs.**

# Integrating with ISO 14001

Environmental management is an important issue in the minerals sector. ISO 14001 is seen as one way of showing the sector's commitment to environmental issues. ISO 14001 requires a site to address energy & water management.

Since ISO 14001 effectively allows a site to set its own environmental targets, all sites may not rate energy & water as significant. If you already have ISO 14001 you need to review the application of energy & water management within it. Remember, energy & water management is an environmental issue that provides good payback.

If you do not yet have ISO 14001 but are working towards it, make sure that energy & water issues are well represented on the working parties.

## TO DO!

- **If ISO 14001 is in place, check its 'compatibility' with energy & water management. If appropriate, revise the ISO 14001 system.**
- **If ISO 14001 is currently being implemented, ensure that the energy & water issues are fully addressed as soon as possible.**
- **Consider combining work instructions from ISO 14001 and other management systems into a single set of integrated work procedures.**

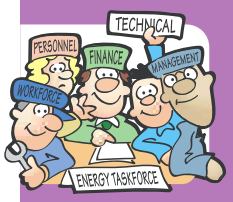
*STAGE 4*

# People & Procedures

four

## STAGE 4

# People & Procedures




**Energy & water management that does not involve people will seldom deliver the full savings potential. It is commonly accepted that the 'people issues' in energy & water management can access savings in the region of 5% for little, if any, expenditure.**

By the time you reach this stage you should have all the support mechanisms in place that energy & water management needs, namely information, policy and responsibility.

At this stage you are looking for more than a 'quick hit' poster campaign. The ultimate objective is to develop a culture of good energy & water management. This cannot be achieved overnight. Significant cultural change can take a number of years to become established. However, throughout this time it will deliver on-going savings.

## Good Housekeeping

Good housekeeping is not the most exciting concept in energy & water management! However, simple improvements in custom and practice can yield worthwhile savings. At this point it worth noting that the 'site culture' will have a significant effect on what happens. If you have a 'poor' attitude on site to safety housekeeping, address this issue before energy & water. Having said that, there are many common issues and themes between energy, environmental, and health & safety housekeeping. It may be appropriate to integrate all of these issues into one global housekeeping campaign.

Good housekeeping is about people having 'good habits'. To acquire these, people need to be aware of what is required, and existing systems must not be obstacles to the new behaviour. (For example, there is little point in asking people to isolate unwanted lights when there is only one master light switch!)

Just asking people to change their behaviour is not enough. You need to monitor that behaviour and provide positive feedback. You also need to realise that the people involved will also have ideas on how things can be done better – ignore these at your own risk!

Regular 'housekeeping' audits can be useful to maintain interest and monitor progress. It is also beneficial if you can get someone from another site to audit yours; then you audit their site - and maybe pick up some good ideas!

### TO DO!

- **Assess the level of housekeeping on site.**
- **Identify the improvements needed.**
- **Develop an approach for delivering the improvements.**
- **Implement and monitor.**

# Purchasing Policies

For many companies, lowest price for specified quality is the basis of purchasing decisions. However, when energy is involved it is usually worth looking beyond first cost. For example, an electric motor, run 24 hours per day, will consume its purchase cost in about 40 days; over 10 years, energy will account for around 99% of the life-cost of the motor. So, spending 5% more on the motor to save 5% of the energy cost would be well worthwhile.

Where clear benefits like this can be identified, consider implementing specific purchasing policies; for example, all new motors (up to 90kW) shall be Eff Class 1 (Higher Efficiency Motors) where available. (Note: These motors may qualify for 100% tax relief in the first year, under the Enhanced Capital Allowances scheme.)

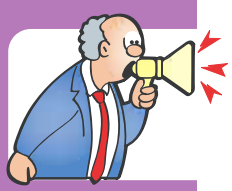
**For details on Eff Class 1 motor ratings and purchasing policies, see:**

General Information Leaflet 56, *Energy savings from motor management policies.*

It may also be appropriate to introduce 'energy clauses' for other energy-using plant.

## TO DO!

- **Review existing purchasing policies/procedures.**
- **Identify cost-effective options.**
- **Implement revised purchasing policies/procedures.**
- **If you cannot implement a policy, look at upgrading specifications to ensure that the right equipment is ordered.**



# Awareness & Training

Awareness is the starting point for solving any problem. If you don't know you have a problem you don't even try to solve it! It is vital that everyone on site is aware of the issues surrounding energy & water management. Training is about knowledge transfer; it is about giving people the skills that they need. Training need not be expensive – ignorance certainly is!

The starting point for awareness and training is to assess your current position. Many organisations with large sites often start by undertaking an 'attitude or awareness survey' to find out what people think about energy & water issues. In many cases this may be part of a broader-based environmental survey. For the smaller site a survey can be carried out as a series of 'face to face' sessions. Ideally, a structured format of questions should be used. (A sample awareness survey is included in the Toolbox.) Having conducted the survey, collate the results. You should now have an insight into what areas you need to address.

A common workforce response is along the lines that energy & water management is a cost-cutting exercise, and one that begs the question, "so what's in it for us?" Some organisations respond with an environmental message. In truth, energy & water management is a cost-cutting exercise. Failure to honestly address this issue can seriously damage the credibility of the energy & water management programme.

On all sites, everyone needs to be made aware of energy & water issues. This can be included in any environmental training delivered as part of ISO 14001. Some individuals may benefit from specific training, e.g. road-vehicle drivers. In addition, consider including energy & water issues in any induction training for new employees.

An interesting approach can be to involve 'outsiders' in raising awareness. Most sites have links with schools, and students can be involved in poster competitions for the site.

The EEBPP has a number of Guides that can help with awareness and training.

## TO DO!

- **Carry out an awareness survey.**
- **Develop an on-going awareness programme.**
- **Identify specific training needs.**
- **Include energy & water in induction and environmental training.**

*STAGE 5*

# Engineering & Investment

five

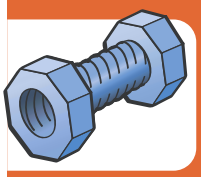
## STAGE 5

# Engineering & Investment

**The previous stages have been relatively low cost - which is the right way to start energy & water management. However, at some point there will be a need to invest in better technology. This may be retro-fitting a Variable Speed Drive (VSD) to a major electric motor, or investing in new plant that incorporates energy & water-saving technology.**

This stage is the key 'Nuts & Bolts' stage. Note that it logically follows PC & Desk and Boots & Hardhat.

## Technical Solutions



Technical solutions can range from the change of a lamp, through to large capital items. Typically, small projects will be carried out as part of maintenance work. Larger projects normally require project engineering and management.

The major technical opportunities are most likely in the following areas:

- motors and drives;
- burners and controls (coating plants);
- tank insulation (coating plants);
- compressed air;
- lighting.

Before committing to any expenditure it is worthwhile drawing up a list of potential projects. Some larger projects may require smaller projects to be carried out first; alternatively, a larger project may eliminate the need for a smaller one. One aid to drawing up such a list is the Technology List for Enhanced Capital Allowances. Regardless of the tax situation, this list provides a starting point for a range of technologies that should be considered.

Enhanced Capital Allowances web site: **http://www.eca.gov.uk**

You may have the required engineering expertise on site. However, it is more likely that you do not, so what can you do? If you are part of a large group there may be a head office engineering function to assist you. If not, you need to look outside the company, where there are two types of advice – free and paid for!

Free, impartial advice can be obtained from the EEBPP. However, this will not provide detailed specifications or plant selection. What it does provide is signposting to the appropriate technology and its application.

Environment and Energy Helpline: **0800 585794**

EEBPP web site: **http://www.energy-efficiency.gov.uk**

Equipment suppliers also provide free advice, based around the supply of their equipment. While this advice will not be independent, it will be plant specific. A good starting point is your existing suppliers plus any relevant trade association.

Some sites will ask a number of suppliers to look at their potential projects, using competition to provide a degree of independent perspective.

An alternative approach is to enter into a 'partnership' agreement with a single supplier. A good example of where this might be appropriate is in the supply of motors and drives. A supply partner may be prepared to provide more engineering support if they know that they are not in competition with other suppliers. With motors and drives, some companies have established partnerships with motor repairers. With this form of agreement the repairer assesses the repair/replace option and, if appropriate, supplies a new motor (to company specification).

**For more information on using a contractor to manage motors, see:**
General Information Leaflet 56, *Energy savings from motor management policies.*


You can also consider consultancy advice. This will be independent, usually in a form you specify. Charges will normally be on an hourly or day-rate basis, so it is important to clearly identify what you want done before commissioning the consultant. Although it will add to the cost of the project, it may be money well spent.

The EEBPP can provide some assistance through the Action Energy scheme, for which there are two options: The first is Site Energy Assessment, which can provide a review of a site's energy management at no cost to qualifying companies. (A number of sites in the sector have already taken advantage of this option under the pilot scheme called Site Specific Advice.) The second is Specific Measures Assistance, which part-funds a consultancy to implement recommendations arising from Site Energy Assessments.

**EEBPP – ACTION ENERGY**
Site Energy Assessments
Specific Measures Assistance

**Contact 0800 585794**

A great opportunity presents itself when a significant item of new plant is planned. As site manager you should be aware of this and able to ensure that energy & water issues are considered. For example, if new trucks are being purchased, ask questions about fuel economy and monitoring.

One interesting approach to planning technical change is to imagine that your site is a greenfield site. What equipment would you specify, what processes would you use? How far are they from what you have got? Does the greenfield kit give you an insight into how to improve the existing processes?

It is worth having a 'project portfolio record book'. This can be a folder that includes details of proposed, rejected and implemented projects. The portfolio can provide a useful resource. A project that is rejected today may be viable in the future. Equally, today's rejection may save you work at a later date if the project comes up again. For the multi-site company, this portfolio should include all sites and be used as a central resource. Details of a successful project on one site can be used to support the implementation of a similar project on another.

## TO DO!

- **Produce a project 'wish list'.**
- **Estimate budget costs and savings.**
- **Identify links (if any) between projects.**
- **Rank projects and compare to site development/business plan.**
- **Shortlist projects for further investigation.**
- **Develop a 'project portfolio record book'.**

# Finance

In any commercial operation the company will need to see a 'return on investment'. For some environmental issues this 'return' may be avoidance of prosecution, or improved image. For energy & water efficiency the return will be cost savings (increased profit). Many organisations use simple payback – how long it takes to get back the money spent – to assess investment. To ration capital expenditure, most organisations set a 'hurdle' for payback. For example, all projects must have a payback of less than two years; if capital is harder to come by this may be reduced to twelve months, or less.

The majority of capital energy & water projects have lives in excess of ten years. This being the case, the use of a two-year payback criterion ignores the savings that will be made in years three to ten. More refined techniques of investment appraisal can be used, normally based on discounted cashflow. However, if these techniques are not accepted by those authorising expenditure, you will still have to make a case using simple payback.

### Reference work:

Good Practice Guide 69, *Investment appraisal for industrial energy efficiency*.

When making a case for investment appraisal it is important to look at **all** aspects of the project, so that **all** costs and **all** savings are identified. For example, the use of a VSD may save energy; it may also reduce plant breakdowns through its soft-start function. If so, include cost savings related to breakdowns.

Having obtained finance and implemented a project, it is critical to carry out a post-project assessment. Did it perform as expected; are savings greater or less than expected? In this way, good investments can be repeated and poor investments can be improved or avoided in future.

There are alternatives to using company money to finance projects. These range from leasing through to shared savings schemes. In general, if you have the available capital (and necessary expertise) you will realise greater savings by financing the project with company money. However, if you do not have the money, then a share of savings is better than no savings at all!

## TO DO!

- **Find out the 'published' and actual investment criteria used.**
- **Find out what funds might be available to you.**
- **If needed, make a budget application for the next year.**
- **Investigate funding alternatives.**
- **Find out if you can benefit from Enhanced Capital Allowances.**

*STAGE 6*

# Continuous Improvement

six

## STAGE 6

# Continuous Improvement

**Energy & water management is not a one-off process - not if you want to maintain and increase the savings made!**

If you are working towards, or have, ISO 14001 then continuous improvement is a philosophy that you are already familiar with, since it is a requirement of ISO 14001.

Experience has shown that there are always improvements to be made in energy efficiency. Nothing stands still; processes change, new technologies emerge, and people move on.

Stage 1 required a relatively intense effort for a short period of time. Stage 6 needs an underlying effort for a prolonged period of time.

## Maintaining Progress

Work carried out by the EEBPP has shown that maintaining progress can be more difficult than starting an energy management programme. Problems arise when energy & water management is not integrated into everyday activity, when the focus is lost, and when people feel they are running out of ideas.

### Suggested reading:

Good Practice Guide 251, *Maintaining the Momentum*. Information to help you sustain energy management.

Look at GPG 251 as soon as possible; it may give you some ideas that can be incorporated at early stages, to sustain energy & water management.

Many sites ask the question, "if we attain a known standard of achievement, what is there to motivate the site to keep improving?" Quite simply, without continued effort you will gradually lose many of the savings you have made. As working practices decline, so efficiency falls.

When you have a mature energy & water management programme, you need to look for innovation to keep it alive. There is a range of 'rewards' that could be introduced, for example:

- improved mess facilities if target savings are met;
- donations to local community causes based on energy & water savings;
- the inclusion of energy & water performance in a bonus scheme.

## TO DO!

- **Ensure a positive management commitment is visible.**
- **Make a point of reporting success to everyone on site.**
- **Consider entering the site in an awards/certification scheme, e.g. QPA Environmental Awards or EMAS.**
- **Review and rethink to keep the programme 'fresh'.**

# The Audit/Review Cycle

In too many instances, energy & water management is initiated and then 'left to get on with it'. In other areas of management, e.g. quality, the system and processes are regularly subject to review. There is no reason why energy & water management should not be conducted in the same way. If it is part of ISO 14001 then this is exactly what must happen.

Ideally, the audit/review cycle should be an annual process. (It could be extended to alternate years - but no longer.) A determining factor may be any environmental reporting requirements the site may have. An environmental report is not complete without a review of energy consumption. An annual audit and review will take some concentrated effort. The good news is that it gets easier after the first year!

Internal reviews can have limitations, so getting an external view may be worthwhile. You may qualify for an Environment and Energy Helpline visit, or a more extended review under Action Energy.

First point of contact for Action Energy:
**Environment and Energy Helpline 0800 585794.**

Alternatives might include a reciprocal arrangement with another site, or the use of a university student on placement.

## TO DO!

- **Carry out a site energy & water audit/balance.**
- **Carry out a site inspection.**
- **Review progress.**
- **Complete a critical review of systems & procedures.**
- **Set targets and objectives for next year.**
- **Report to interested parties.**

# Multi-site Management

seven

# Multi-site Management

**This Guide has been written for the individual site manager. However, many sites belong to major groups and, as such, do not have the autonomy of the single site. This section of the Guide looks at the issues relating to the multi-site operation.**

From a review of the sector it has been shown that energy & water management needs to be effective at site level and supported at corporate level. If this approach is used, the site 'pulls' the 'centre' to support it rather than the centre 'pushing' the site into energy & water management.

This Guide can be used as the basis of an energy & water management programme for a multi-site operation, with the 'centre' project managing the implementation of this Guide on a site-by-site basis. Some issues will need to be addressed slightly differently when looking at multiple sites.

## Energy Supply

Most multi-site operations have central procurement of energy supplies. While this can lead to economies of scale it can also distance the individual sites from the cost and tariff arrangements. Where central procurement does take place it is important to ensure that each site has sufficient information to enable it to make effective use of any tariff/contract opportunities that exist. For example, to manage its electrical loads effectively a site needs to know if a change of electricity contract means that the day/night rate has been replaced by the Seasonal Time of Day rate.

## Policy

In a multi-site operation there is probably no benefit in each site drafting its own policy document. However, there may be benefit in each site 'signing-up' by endorsing the policy.

## Energy & Water Information

Economies of scale may also apply in the collection and analysis of energy & water information. Remember, energy & water information is used to support energy & water management - it is not an end in its own right. Often, with a large amount of data this gets overlooked. The option to establish league tables and internal benchmarking exists and should be explored.

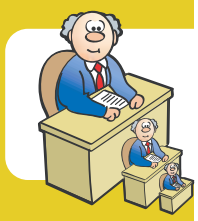
## Internal Best Practice

Having a number of sites allows you to compare performance and 'experiment' with best practice. For example, one site could be chosen as a pilot site to trial new practices or procedures. These can be closely monitored and, where appropriate, 'transferred' to other sites in the group.

# Engineering

This is one area where the multi-site operation may appear to have an advantage over the single site. Normally, the larger company has professional engineering capability. However, the resource available for each site might be quite limited, e.g. one electrical engineer covering 100 sites. This engineer will also have wider engineering responsibilities, thereby limiting the time he/she can spend on energy efficiency. This is where the establishment of company-wide energy efficiency engineering standards will assist.

# Implementing this Guide in a Multi-site Operation



Part of the problem for the head office 'energy & water' specialist is that he/she will have responsibility for a large number of sites. This limits the effort that can be applied to each site if they all receive equal treatment. One solution is to use an approach that makes the most effective use of time and facilities.

Below are a number of suggestions as to how you could use this Guide. Feel free to mix and match or otherwise adapt the ideas to suit your operation.

## Option A

Begin by identifying how many sites you have and collecting basic data on energy consumption and cost, water consumption and cost, and production figures. Calculate site SECs and compare with ECG 70. Rank the sites in order of difference between each SEC calculated and the sector SEC – put the 'worst' sites at the top. Select the top five and 'deploy' this Guide. As these sites progress, introduce additional sites by working down the league table.

## Option B

Carry out the same analysis as in Option A. Then, select the two 'best' and two 'worst' sites. Deploy this Guide, then compare and contrast. From the results, develop a range of company-wide procedures that can be used at all sites.

## Option C

Identify a small number of sites with managers that are receptive to energy & water management. Deploy this Guide and develop an internal best practice programme based on these sites.

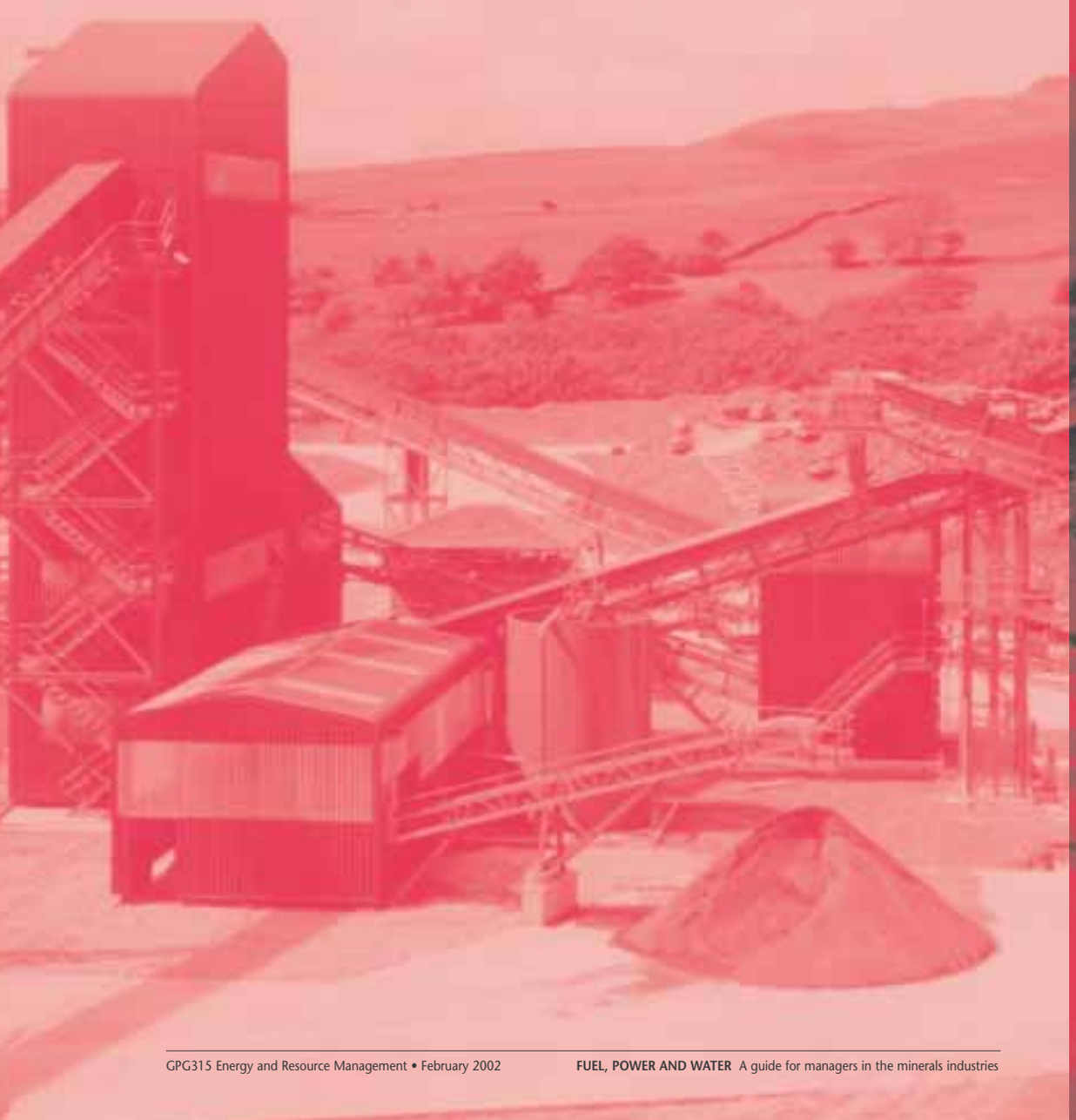
## Option D

Issue this Guide to all sites, along with an accompanying document 'adapting' the Guide to your company and setting out what support you can give. Sit back and wait!

## TO DO!

- **Review this Guide.**
- **Decide how it can be best used in your organisation.**
- **Deploy the Guide!**
- **Monitor and support.**

# Examples



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# Examples

## The following pages are examples of energy management in this sector.

**They have been selected from EEBPP publications, site visits, and liaison with the industry.**

# Example 1

**Early in 1999, energy efficiency took on a heightened importance for a group of regional companies. Having reviewed Energy Consumption Guide 70, *Energy use in the minerals industries of Great Britain*, the group decided to implement a year-long monitoring programme for six sites in the south west of the UK. This involved gathering data on monthly tonnage produced, oil, gas and electricity consumption, and oil burnt in the preparation of asphalt.**

After monitoring for a year, the data gathered were used to set targets for the six sites involved in the programme. The company produced its own spreadsheet-based energy calculator, using the principles set out in ECG 70. As a result, the company has also been able to report on the energy cost per tonne produced.

Following on from the original programme, another part of the group based in the east, implemented monitoring, based on ECG 70, for that company's sites.

Interestingly, the two companies adopted different approaches to reporting energy performance. A head office based working group initially identified two possible approaches. The intention was to test them and, depending on the outcome, select the best one. For the south west area, reporting was based on actual kWh/tonne. For the eastern area, an indexed figure was used to present results in a league-table format.

Both approaches have been found to work well, with energy savings being made and recorded in both companies. As a result, both approaches are in continued use.

This example illustrates a number of points:

- ECG 70 provides a good starting point for energy monitoring.
- Knowledge of consumption and production is needed before targets can be set.
- Different approaches can be used in presenting information.

# Example 2

**One company was looking at operating energy benchmarking between a number of sites. The company noted that Energy Consumption Guide 70, *Energy use in the minerals industries of Great Britain*, looks at all energy used on site, including fixed plant, mobile plant, restoration, overburden removal, etc. However, contractors carry out the restoration work at some of the sites. After initial enquires it became clear that the contractor involved was not prepared to provide details on fuel consumption. (The contractor was concerned that energy consumption details could become an issue in future contract negotiations.)**

To provide a common measure between sites with and without contract restoration, the company monitored energy consumption used in restoration at the sites where in-house restoration was employed. This enabled the company to calculate Specific Energy Consumption (SEC) **excluding** restoration for those sites. This SEC could then be used throughout all sites within the company.

This example shows that alternative approaches to monitoring are sometimes required to provide usable comparative measures. However, it should be noted that this company cannot directly compare its SECs with those in ECG 70.

# Example 3

**This example is taken from Good Practice Case Study 354, *Energy monitoring & management systems.***

In 1990, a quarry installed a new computer-controlled roadstone plant with a new metering system allowing consumption to be monitored at half-hourly intervals. This system also allows the control of electricity maximum demand. (Maximum demand management can reduce electricity costs, the amount depending on the particular tariff in operation.)

As the plant is computer-controlled, the company has programmed maximum demand limits that allow the computer to automatically turn off specified electrical plant to avoid exceeding limits. In addition, the control room operators are regularly briefed on energy conservation, including an appreciation of plant-running costs. As a result, they will switch off plant during breakdowns of more than 15 minutes.

This example shows the value of knowing what is being consumed by an energy-intensive operation like coated stone. Interestingly, one control mechanism is automatic, while the other is based on operator awareness and action.

# Example 4

**This example is taken from Good Practice Case Study 354, *Energy monitoring & management systems*, and looks at the installation and operation of a new roadstone plant.**

Having installed half-hourly electrical monitoring, a company implemented a number of improvements, but still had a night load that averaged 75 kWh/half-hour period. Further investigations showed that most of this consumption could be traced to the bitumen-heating plant. The trace heating of pipelines and storage hoppers was left on continuously, even when they were not in use.

Control circuits were fitted to ensure power was only provided during production hours. As a result, the average night load was reduced to 15 kWh/half-hour period – a saving of 60 kWh/half-hour.

This example shows that, even when new plant is installed, it may not be set up to operate in the most efficient manner. Furthermore, the need for plant monitoring and investigation is emphasised.

# Example 5

**This example is taken from Good Practice Case Study 358, *Installation of Variable Speed Drives.***

At one quarry, wastewater from the Red and White Sand wash plants and other equipment is collected in an effluent sump before being pumped to settlement lagoons by a large, land-based pump. The 90 kW pump motor was previously controlled (on/off) by float-level switches. With only the White Sand plant operating, the pump output was regulated by partly closing a discharge valve; with both plants operating, the valve was fully open.

In 1994, a 75 kW Variable Speed Drive (VSD) was fitted to the motor. (Tests had shown that this would be adequate, as the maximum load drawn by the motor was less than 75 kW.) An ultrasonic level sensor controlled the VSD.

The modifications cost £8,400 and generated savings of £3,760/year, making a simple payback of 2.2 years. It should be noted that if this project were undertaken today, the VSD would qualify for 100% first-year tax relief, under the Enhanced Capital Allowances scheme; furthermore, it is likely that the VSD would cost less. The current Climate Change Levy would also improve the payback.

This example illustrates how changing circumstances can improve a project's payback. A project with a payback of over two years around six years ago would probably have a much shorter payback period today.

# Example 6

**This example is taken from Energy Consumption Guide 70, *Energy use in the minerals industries of Great Britain*.**

Since 1995, one company has been running a monitoring system for its quarry and coated-stone operations. Every manager completes a monthly calculation, with targets being set for each site. Site and plant management then have the responsibility of maintaining or improving their performance. The whole scheme is co-ordinated at a regional level.

It is estimated that the implementation of this scheme has led to the company reducing its energy bill by about 15% in less than two years.

The whole process was relatively low cost. The most important requirements were the education of managers, the raising of workforce awareness, and ensuring commitment to the programme.

This example shows that significant savings are possible without significant outlay, if a company can establish an effective monitoring system combined with a motivated workforce.

# Example 7

**This example is based on Good Practice Case Study 222, *Purchasing policy for Higher Efficiency Motors*.**

The extraction and processing of china clay requires extensive use of electrically driven pumps. One company has around 4,880 working motors, with a further 800 motors held in stock for replacement. The company estimates that 85% of electricity consumption is attributable to these motors, which range in size from 1 - 600 kW.

The company made comparisons between standard and Higher Efficiency Motors (HEMs) in the mid-1980s. At that time the HEM was more expensive than the standard motor, with paybacks ranging from 0.5 - 2.5 years. Subsequently, the price difference has been eroded.

Following successful tests, the company decided to make the use of HEMs a company policy. Currently, about 25% of the company's installed motor capacity consist of HEMS, with a target of 100% within 5 years.

This programme of HEM upgrades is making annual savings of £100,000.

This example shows that an in-depth analysis of one plant item can sometimes be widely replicated and easily implemented by making it company policy.

# Example 8

**This example looks at an old quarry that had grown in size over a number of years.**

Over time, a total of three, separate and independent air compressors had been installed. A review of the plant suggested that duplication and inefficiency existed. Accordingly, the air-distribution systems were rationalised and integrated. As a result, only two of the compressors were needed to meet the full demand. The third compressor was taken out of service but retained to provide plant 'redundancy'. It is estimated that this relatively low-cost project reduced the energy requirement for compressed air by 25 - 30%.

This example shows that when a site has grown 'organically' it is often worth reviewing the total system against current requirements. In this case the outcome was an improved system, a usable standby plant, and energy savings (all for the cost of some pipework).

# Example 9

**This example looks at mobile-plant use and monitoring.**

Often, energy (fuel) use of mobile plant is taken as a given. However, any study of mobile plant will show that it seldom has 100% utilisation. At one particular site the quarry manager has been particularly effective in getting mobile-plant operators to turn off the plant when it is idle/non-productive. This has now become an established practice. The manager maintains fuel use per hour figures for each plant item so that he can assess performance by plant item and operator.

Having become interested in the monitoring of mobile plant, the manager has been looking for improved and more refined techniques. He was recently approached by one mobile-plant manufacturer to test their 'vehicle performance computer'. This kit not only records fuel consumption, it includes time spent moving, idle time, and time in each gear, plus many other parameters.

The trial has provided a wealth of information on the operation of one specific plant item. Arguably, the equipment provides more data than is needed for ongoing energy performance monitoring.

This example shows that simple measures can be effective, while some technology can provide potential data overload. For effective management it is important to strike a balance between what can be obtained and what is needed.

# Example 10

**This example looks at an innovative use of schoolchildren!**

In common with many companies in the sector, one company has an active educational programme with local schools. The principal motivation for the programme is to educate the students about both the need for the minerals industries and the fact that quarries are not playgrounds.

The format for site visits is to provide the students with a questionnaire to complete as they are taken round the site. At certain locations they ask the operators questions and note answers on their clipboards.

The company decided to add a number of energy questions to the questionnaire. For example, the crusher operator is asked what he does to save energy.

This approach has been found to reinforce the site's awareness-raising initiative.

This example shows that awareness raising can be carried out in a number of ways and does not need to be expensive.

# Example 11

**This example looks at technology versus operators!**

A quarry site was approached by a manufacturer of motor optimisers to conduct a free trial looking at the effect of an optimiser on a cone crusher. After installation and monitoring, it was confirmed that the equipment was saving energy. However, further investigation showed that the majority of the savings occurred when the crusher was running idle, i.e. when it was not crushing stone. (Typically, an unloaded motor can use 20 - 40% of its full load rating.)

This raised a question for the site; if the operators practised better control of the crusher, would the optimiser still be cost effective?

To shut the crusher motor off more frequently, a soft start would be needed. Since the optimiser was already installed the company decided to continue its use.

This example shows how, for a given plant item, there may be more than one way of achieving savings.

# Toolbox

# Toolbox

## This section comprises checklists and sample documents for your use.

**The checklists are not intended to be comprehensive – their purpose is to get you started. Each checklist can be easily tackled in one go. Before putting on your Boots & Hardhat, read through the checklist and make sure you understand what it is asking. You may need some additional reading, depending on your existing level of knowledge in the area. Where appropriate, the checklists refer you to more detailed sources of information.**

Except for the Quick Site Profile, each checklist requires you to answer **YES** or **NO** to a number of questions. If your answer is DON'T KNOW, tick the **NO** box. When each checklist has been completed the **NOs** will provide you with an **ACTION LIST** for that topic.

You may find it worthwhile to create electronic versions of the checklists, which you can modify to meet your own specific needs. For example, you may want to add plant-specific information or delete items that do not refer to your site.

# Quick Site Profile

**If you want a quick assessment of where you are with energy & water management, this is for you. It is not highly accurate but will give you a good feel for where you are in the efficiency stakes.**

Answer the following questions by marking the appropriate box. Then join up all the marked boxes. This will give a 'profile'. If it is straight and all in the Yes column – well done, keep up the good work. If it is all in the No column – welcome to ground zero! More likely it will zigzag, giving you a clear indication of which areas need to be tackled.

| | No | In progress | Yes |
|---|---|---|---|
| 1. Named person, on site, responsible for energy efficiency. | ☐ | ☐ | ☐ |
| 2. Energy policy – drafted and published. | ☐ | ☐ | ☐ |
| 3. Metering installed to segregate major energy users. | ☐ | ☐ | ☐ |
| 4. Specific Energy Consumptions calculated regularly (monthly minimum). | ☐ | ☐ | ☐ |
| 5. Water use monitored. | ☐ | ☐ | ☐ |
| 6. Fuel to mobile plant is monitored, by plant item. | ☐ | ☐ | ☐ |
| 7. Energy & water performance targets set. | ☐ | ☐ | ☐ |
| 8. Annual energy & water report produced. | ☐ | ☐ | ☐ |
| 9. Energy & water efficiency procedures are part of work procedures (e.g. ISO 14001). | ☐ | ☐ | ☐ |
| 10. Energy & water project programme in place. | ☐ | ☐ | ☐ |

As an alternative, score each answer: No = 0; In progress = 1; Yes = 2.

Add up the total score and convert to a percentage. Maximum score is 20, which equals 100%.

**Date:** ..... **Completed by:** .....

# Energy & Water Supply

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List.**

| | YES | NO |
|---|---|---|
| 1. Do you have details on site of your electricity and gas tariffs? | | |
| 2. Has your electricity (gas) supply been the subject of competitive tender in the last 12 months? | | |
| 3. Are you fully aware of any penalties you may incur with your energy supply, e.g. power factor, maximum daily gas take? | | |
| 4. Do you get a full copy of your relevant energy & water invoices? | | |
| 5. Do you check your energy & water invoices for accuracy? | | |
| 6. Do you have adequate oil storage on site to get the best price for oil deliveries? | | |
| 7. Have you checked that your water meter or meters are the right size? | | |
| 8. Do you claim 'rebates' for water not disposed of through the water company's system? | | |
| 9. If you are part of a group, does head office supply you with all the relevant tariff data? | | |
| 10. Do you carry out regular checks of power factor and power factor correction equipment? | | |
| 11. Do you practise electricity load management to maximise use of low-tariff periods and minimise the use of high-tariff periods? | | |
| 12. If you have on-site generation of electricity, have you reviewed its cost relative to mains supply? | | |

**Date:** ..... **Completed by:** .....

# Electric Motors & Drives

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List.**

| | YES | NO |
|---|---|---|
| 1. Are all the major motors on site the right size for the job? *(Motors run more efficiently at higher loadings; typically, motors are oversized for the job they do – particularly with fans and pumps.)* | | |
| 2. Are all motors turned off when not doing useful work? *(Soft-start controls may be needed to enable more frequent switching.)* | | |
| 3. Are all new and replacement motors Higher Efficiency Motors (Eff Class 1 up to 90 kW, WIMES[1] over 90 kW - refer to ECA web site for further information www.eca.gov.uk) where available? | | |
| 4. Do you make motor repair/replace decisions based on life-cycle costs? | | |
| 5. Have you reviewed water-pumping systems to see if there is a case for using Variable Speed Drives? | | |
| 6. Have you reviewed air movement/ventilation systems to see if there is a case for using Variable Speed Drives? | | |
| 7. Have all major drive systems been checked for alignment? *(Small alignment errors can increase energy consumption by 5%.)* | | |
| 8. Where motor-driven plant is lubricated, is the most energy-efficient lubricant used? *(Some specialist oils can reduce energy consumption by 5%.)* | | |
| 9. Are all drive systems well maintained? *(No unnecessary slack in belt drives; well lubricated chain drives, etc.)* | | |
| 10. When new motor-driven plant is specified, is energy efficiency a consideration? | | |

**Essential publication:** Good Practice Guide 2, *Energy savings with electric motors and drives*. **Of interest:** Good Practice Case Study 358, *Installation of VSDs and small submersible pumps*.

**Additional information:** **www.eca.gov.uk** Higher Efficiency Motors and Variable Speed Drives may be eligible for Enhanced Capital Allowances; full details on web site or from suppliers.

[1] Water Industry Mechanical and Electrical Standard.

**Date:** ..... **Completed by:** .....

# Extraction, Loading & On-site Haulage

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List. This checklist should also be used for all plant involved in restoration work.**

| | YES | NO |
|---|---|---|
| 1. Do you know the cost of the energy/fuel used by all the plant involved in extraction, loading and hauling on your site? This should include plant working on restoration. | | |
| 2. Is plant well maintained, e.g. tyres in good condition and at correct pressures, fuel leaks repaired, etc? | | |
| 3. Is energy/fuel consumption recorded for each plant item? | | |
| 4. Are haul roads maintained to a good standard? *(Regardless of gradient, poor surface condition increases fuel consumption.)* | | |
| 5. Have the energy implications of overburden removal and location been assessed? | | |
| 6. Have plant operators been trained in energy/fuel-efficient operation of the plant? | | |
| 7. Is plant turned off during idle periods? If yes, does this save energy/fuel? | | |
| 8. If you have a plant 'warm-up' period at the start of the day, have you looked at the energy efficiency implications? | | |
| 9. Do you know what the manufacturer's energy performance rating for the plant is? | | |
| 10. Do you compare plant energy performance with the manufacturer's rating or some other benchmark? | | |
| 11. If a plant item is known to have poor energy performance, is it investigated as a matter of urgency? | | |
| 12. Is energy performance a consideration when specifying new plant? | | |

**Date:** ..... **Completed by:** .....

# Crushing, Grinding & Screening

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List.**

| | YES | NO |
|---|---|---|
| 1. Do you know the energy cost of your crushing, grinding & screening operation? *(If metering is not installed, cost can be estimated from motor size, running times and average electricity cost.)* | | |
| 2. Is material delivered to each part of the process at the optimum size? (If material is too large, additional energy will be required. In this case a review of blasting or extraction may be necessary.) | | |
| 3. Is all plant well maintained and regularly cleaned? | | |
| 4. Is plant shut down when idle? | | |
| 5. Do the operators know the effect of running the plant unloaded? | | |
| 6. Has the energy performance of the complete processing stream been reviewed? | | |
| 7. Given the choice, is the lowest energy plant used for the process? | | |
| 8. Do plant-operating procedures include guidance on energy efficiency? | | |
| 9. Is energy performance a consideration when specifying new plant? | | |

**Date:** ..... **Completed by:** .....

# Material Transfer

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List.**

| | YES | NO |
|---|---|---|
| 1. Do you know the energy cost of material transfer on site? | | |
| 2. Are all conveying systems well maintained? | | |
| 3. Are conveying systems shut down when idle? | | |
| 4. Have soft-start systems been installed to reduce starting loads and enable more frequent switching? | | |
| 5. Are all belts and drives regularly inspected for alignment and damage? | | |
| 6. For pumped systems, has the pump rating been checked to see if it is correct for the duty? | | |
| 7. For pumped systems, has the selection of pump lining taken account of energy issues? | | |
| 8. Are all hoses inspected regularly? | | |
| 9. Is energy performance a consideration when specifying new plant? | | |

**Date:** ..... **Completed by:** .....

# Coated Materials

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List.**

| | YES | NO |
|---|---|---|
| 1. Do you know the total energy cost of producing coated materials? | | |
| 2. Has plant thermal insulation been inspected within the last six months? | | |
| 3. Is trace heating on only when required? | | |
| 4. Are process temperatures the lowest possible – consistent with product quality, production and energy use? | | |
| 5. Is bitumen storage heating set at the minimum level? | | |
| 6. Are process and energy records kept for each batch/run? | | |
| 7. Have energy targets been set for coated production? | | |
| 8. Are plant operators aware of the energy cost per tonne? | | |
| 9. Has the choice of fuel been reviewed from both cost and environmental viewpoints? | | |
| 10. Is energy performance a consideration when specifying new plant? | | |

**Date:** ..... **Completed by:** .....

# Ready-mixed Concrete

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List.**

| | YES | NO |
|---|---|---|
| 1. Do you know the total energy & water cost of producing ready-mixed concrete? | | |
| 2. Is all excess water recycled? | | |
| 3. Is all equipment turned off when not in use? | | |
| 4. Are you aware of the different cost of electricity at different times of day and year? *(This assumes that a variable-rate tariff is in place.)* | | |
| 5. Is production scheduled to avoid high energy cost periods? | | |
| 6. Is energy performance a consideration when specifying new plant? | | |

**Date:** ..... **Completed by:** .....

# Sand Classification, Dewatering & Processing

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List.**

| | YES | NO |
|---|---|---|
| 1. Do you know the annual energy & water costs for the production of (silica) sand? | | |
| 2. Is equipment turned off when not in use? | | |
| 3. Have you reviewed the drying process in terms of energy consumption? | | |
| 4. Have all pump/motor sizes been checked to make sure that they are the correct rating for the job? | | |
| 5. Is excess/waste water re-used or recycled? | | |
| 6. Have you considered the use of submersible pumps? | | |
| 7. Is energy performance a consideration when specifying new plant? | | |

**Date:** ..... **Completed by:** .....

# Dimension Stone Production

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List.**

| | YES | NO |
|---|---|---|
| 1. Do you know the total annual energy & water spend for all operations? | | |
| 2. Is all machinery turned off when it is not productive? | | |
| 3. Is excess/waste water re-used/recycled? | | |
| 4. Are machines compared on energy consumption? | | |
| 5. Given a choice, is the most efficient equipment used for the job? | | |
| 6. Is energy performance a consideration when specifying new plant? | | |

**Date:** ..... **Completed by:** .....

# Compressed Air

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List.**

| | YES | NO |
|---|---|---|
| 1. Have you estimated the annual cost of compressed air for your site? *(Approximate calculation: installed load of compressor(s) (kW) multiplied by annual on-load running hours multiplied by average cost of electricity.)* | | |
| 2. Is there an effective system for reporting and repairing air leaks? | | |
| 3. Has all redundant compressed air pipework been permanently isolated – ideally, disconnected? | | |
| 4. Is compressed air generated at the lowest possible pressure? | | |
| 5. Are compressors in a good state of repair, e.g. clean inlet filters, plant free from dust and debris? | | |
| 6. Have you looked at alternatives to compressed air driven plant? (For work done, compressed air is about ten times the cost of electricity.) | | |
| 7. Have you checked to see if the pipework is correctly sized? | | |
| 8. Does your system have automatic drain traps fitted? | | |
| 9. If you have multiple compressors do you have automatic controls to match compressors to demand? | | |
| 10. Are the compressors and plant serviced on a regular basis? Do you have records? | | |
| 11. Is compressor air intake located outside the plant room? Is it free from dust contamination? | | |
| 12. Are compressed air dryers (if fitted) correctly sized and in good working order? | | |

## Essential publication:

Good Practice Guide 126, *Compressing air costs*.

**Date:** ..... **Completed by:** .....

# Heated Buildings

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List. You may want to use a number of copies of this checklist to cover different buildings.**

| | YES | NO |
|---|---|---|
| 1. Is the building in a good state of repair? | | |
| 2. Are windows and doors suitably draught proofed? | | |
| 3. Where appropriate, are automatic door closers fitted? | | |
| 4. Is building insulation adequate? | | |
| 5. Is heating plant regularly serviced? Is the boiler combustion efficiency checked? | | |
| 6. Has the heating system both time and temperature controls? Are they properly set and used? | | |
| 7. Is the heating system set to the right temperature? *(Note: The maximum set point for a heating system is 19°C.)* | | |
| 8. If the heating system supplies different areas, are there separate temperature (time) controls? | | |
| 9. Is all heated pipework suitably insulated? | | |
| 10. If air-conditioning units are fitted, are these interlocked to prevent heating and cooling at the same time? | | |
| 11. Are comfort air-conditioners turned off when the building is unoccupied? | | |
| 12. If there is a hot-water storage system, is it suitably insulated? | | |
| 13. If there is a hot-water system, is it temperature controlled? | | |

## Suggested reading:

Energy Consumption Guide 18, *Energy efficiency in industrial buildings and sites*; Energy Consumption Guide 19, *Energy use in offices*.

**Additional information: www.eca.gov.uk**

Some heating and insulation products may be eligible for Enhanced Capital Allowances; full details on web site or from suppliers.

**Date:** ..... **Completed by:** .....

# Lighting

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List. You may want to use a number of copies of this checklist to cover different areas, e.g. offices, plant and external.** ***(You may also want to invite a lighting supplier to carry out a survey of your site. They will be able to measure lighting levels and provide fully costed proposals for improvement. What they can't do is get your people to turn off unwanted lights!)***

| | YES | NO |
|---|---|---|
| 1. Have you estimated the annual cost of lighting for your site? *(Approximate calculation: installed load of lighting (kW) multiplied by annual running hours multiplied by average cost of electricity.)* | | |
| 2. Are the right levels of lighting provided, i.e. above minimum safety requirements but not excessive? | | |
| 3. Do you know if you are using the most efficient lamps for the job? | | |
| 4. Are there adequate controls to allow lights to be used only where needed? | | |
| 5. Do external lights have time or photocell control? | | |
| 6. Are lighting fittings clean and well maintained? | | |
| 7. Are lights always switched off in unoccupied areas, e.g. plant rooms, stores? | | |
| 8. Have tungsten lamps been replaced with more efficient lamps, e.g. compact fluorescent lamps (CFLs)? | | |
| 9. Where fluorescent tubes are used, are they slimline (26 mm)? | | |
| 10. Have you considered using high frequency fluorescent lighting? | | |
| 11. Do people turn off unwanted lights? | | |

## Essential publication:

Good Practice Guide 158, *Energy efficiency in lighting for industrial buildings – A guide for building managers.*

**Additional information: www.eca.gov.uk**

Many lighting products may be eligible for Enhanced Capital Allowances; full details on web site or from suppliers.

**Date:** ..... **Completed by:** .....

# OFFICES

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List. You may want to use a number of copies of this list to cover different office areas.**

| | YES | NO |
|---|---|---|
| 1. Have you checked the area, using the Heated Buildings and Lighting checklists? | | |
| 2. Are PCs turned off when not in use? | | |
| 3. Are PC energy-saving features enabled? | | |
| 4. Is office machinery, photocopiers, etc. turned off when not needed? | | |
| 5. If photocopiers have a 'sleep mode', is this enabled? | | |
| 6. Are tea/coffee catering facilities energy efficient? | | |
| 7. When new office equipment is purchased, is its energy efficiency reviewed? | | |
| 8. Is the use of portable electric heaters strictly controlled? | | |
| 9. Is effective use made of e-mail? *(Poor use would include printing all e-mails!)* | | |
| 10. Are office staff aware of their role in saving energy & water? | | |

## Essential publication:

Good Practice Guide 118, *Managing energy use. Minimising running costs of office equipment and related air-conditioning.*

**Date:** ..... **Completed by:** .....

# Water

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List.**

| | YES | NO |
|---|---|---|
| 1. Has your water supply been checked for leaks within the last six months? *(Once a system is known to be leak free, on-going consumption monitoring should indicate leakage.)* | | |
| 2. Are all water leaks, dripping taps, etc., repaired as soon as practicable? | | |
| 3. Have you conducted a water balance for the site? *(This compares all the incoming water with all the outgoing water. Include all paths, e.g. ready-mixed concrete will take water off site.)* | | |
| 4. Have you taken action to minimise all water consumption? | | |
| 5. Has the use of flow restriction and control devices been considered? | | |
| 6. Have you ensured that mains quality water is used only where that quality of water is required? | | |
| 7. Where dust suppression water sprays and wheel washers are used, are they water efficient? | | |
| 8. Are water sprays and hoses turned off when not required? | | |
| 9. Have all opportunities for the re-use of wastewater been examined? | | |

## Essential publication:

Good Practice Guide 67, *Cost-effective water saving devices and practices*. This Guide is available from Envirowise, formerly the Environmental Technology Best Practice Programme, via the Environment and Energy Helpline 0800 585794.

**Date:** ..... **Completed by:** .....

# (PUBLIC) ROAD HAULAGE

**For each item on this checklist there is a Yes or No answer. When you have completed the checklist the No answers will provide you with an Action List. This checklist is written for company owned and operated off-site haulage. If you have franchised or contract haulage you should ensure that these guidelines are still followed – some organisations include fuel economy in contract specifications.**

| | YES | NO |
|---|---|---|
| 1. Do you know how much road transport is costing you? | | |
| 2. Do you record mpg (litres/100 km) for each vehicle/driver? | | |
| 3. Have drivers received fuel-economy training within the last two years? | | |
| 4. Are tyres regularly checked for pressure and wear? | | |
| 5. Do you have a regular servicing programme for all vehicles that includes issues relating to fuel economy? | | |
| 6. Are routes planned (where possible) with fuel economy in mind? | | |
| 7. Is empty running reduced to the minimum practicable level? | | |
| 8. Do you have fuel-economy benchmarks for your vehicles? | | |
| 9. Have you considered imposing company speed limits to save fuel? | | |
| 10. Is fuel economy a consideration in vehicle selection? | | |
| 11. Have you considered alternatively fuelled vehicles? | | |

## Essential publication:

Fuel Efficiency Booklet 20, *Energy efficiency in road transport*.

## Additional reading:

GPG 218, *Fuel-efficient fleet management*.
GPG 307, *Fuel management guide*.

# Energy & Water Policy Statement

## Introduction

*(Wording, or mission statement, to set the context for the energy & water policy statement.)*

As part of our commitment to improved environmental management, we formally set out here our intentions to improve our management of energy & water resources. This statement covers all energy & water used on site, including fuel for mobile plant, and all fuel for off-site road haulage.

## Statement of commitment

*(Overall objectives that you see as key points.)*

As a company, we are committed to:

a) increasing our energy & water efficiency (energy/water consumed per unit of production);

b) actively managing our procurement and consumption of energy & water;

c) reducing the environmental impact arising from our consumption of energy & water;

d) investing in appropriate, clean, energy & water-efficient technologies.

To achieve this we will:
*(Mechanisms to achieve stated objectives.)*

- develop, and subject to annual review, an energy & water management strategy for the company;
- annually set and review energy & water management objectives;
- implement appropriate systems for the measurement of energy & water performance;
- regularly report on energy & water performance;
- designate named individuals as having responsibility for energy & water efficiency;
- provide appropriate energy & water efficiency training to all employees;
- actively seek new opportunities of improving energy efficiency as part of the overall continuous improvement of our business;
- where advantageous, incorporate energy & water efficiency into other company policies.

**Signed**

**Dated**

# Awareness Survey

**Knowledge of the awareness of and attitude to energy & water issues on site can provide a key to realising low-cost savings.**

The following set of questions could form the basis of a site survey. It should be noted that by carrying out a survey you will also raise the level of awareness.

Before asking the questions, make sure you know the answers yourself!

| Question | Answer |
|---|---|
| 1. How much do you think we spend on fuel, power and water each year? | |
| 2. Which item of plant on site uses the most electricity? | |
| 3. Why should we try to reduce the amount of energy & water we use? | |
| 4. Where do you think the biggest waste of electricity/gas/water is on site? | |
| 5. Which is more expensive, natural gas, electricity or compressed air? | |
| 6. A motor running unloaded uses hardly any power – true or false? | |
| 7. Did you know that businesses have to pay a government levy on electricity and natural gas? | |
| 8. Do you think that this company is really interested in saving energy & water? | |
| 9. There is no point in turning off lights to save energy as it takes more energy to turn them back on – true or false? | |
| 10. What could you do to help save energy & water? | |